Kintarra Tech

Key Drivers of the TPM Market

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The Need for IT Maintenance

Pain Points that IT Maintenance Companies Address:

Server Extensions

As reported in our other papers, technology companies need to extend server refresh cycles to buy GPUs for AI. Technology companies can extend the actual useful lives of IT through IT maintenance.

Security protection

IT maintenance can help reduce cybersecurity risk and protect companies from the legal and reputational ramifications. 79% of organizations have suffered a detected ransomware attack, so this protection is crucial.

Need for scale

Since IT maintenance is inherently a troubleshooting area, deep expertise, time flexibility, and variety of expertise make a strong case for economies of scale. Therefore, technology companies should outsource IT maintenance. In fact, outsourcing maintenance can lead to 60% savings. Outsourcing may also allow organizations to focus on their core areas.

Why TPM Specifically?

One maintenance provider

Using OEMs would require technology companies to go to different servicers for different products. Technogroup's study has found that almost four in five (78%) of firms with data centers use multiple Original Equipment Manufacturers (OEM). Almost a third (31%) use up to five different OEMs, while half (47%) use up to seven. This is time-consuming and costly in terms of negotiating pricing and contracts. TPMs consolidate this maintenance.

Reduced Conflict of Interest

The OEM has an incentive to drop support for old models to favor new models. This usually occurs at 3– 9 years depending on the brand and specific technology. TPM gives companies control of their equipment life cycle, allowing them to focus spending on leading-edge technologies such as GPUs and improve environmental performance.

Lower cost of service

Additionally, even before the official end-of-serviceable-life announcement, OEM maintenance may get far more expensive than TPM. In fact, clients can save up to 50 – 70% off OEM services depending on the level of service, with an average of 60%.

Increased Flexibility

TPM service contracts tend to be more flexible than OEM service contracts both in terms of scope and time. As TPMs are independent and specialized, they can also provide a higher quality and breadth of service than OEMs. TPMs may also provide flexibility in the term of the contract. For these very reasons, it is important for TPMs to emphasize that they operate independently of OEMs.

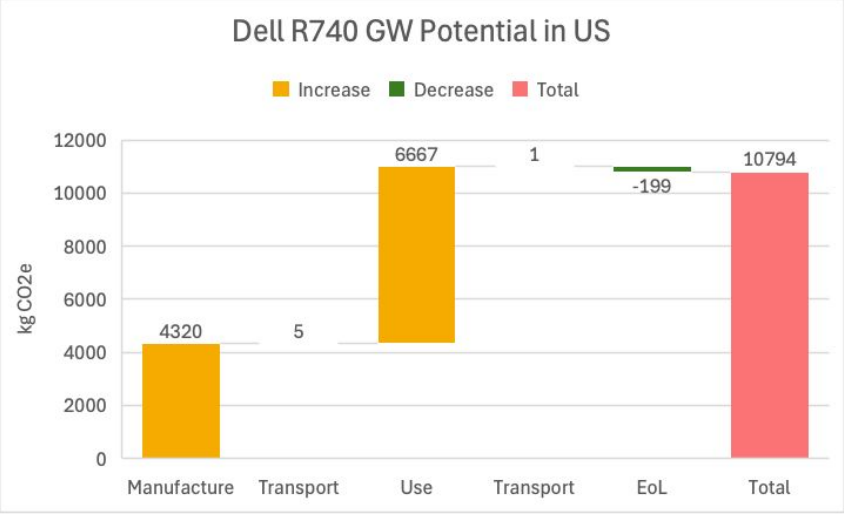
With so many reasons to choose third-party maintenance over OEM maintenance, it is no wonder that 70% of large companies now use TPM servic

AI, TPM, and the Environment

AI is as revolutionary as the invention of the automobile, but unfortunately has the side effect of devastating pollution. GPUs demand an overwhelming amount of power – the NVIDIA H100 consumes 700W of power, equivalent to 10 – 20 personal computers. Even worse, without extended maintenance, companies would dispose of their IT assets, often unsafely leaking toxic chemicals into the environment. In fact, only 22% of companies dispose of their IT assets safely.

Without TPMs, companies would be forced replace their servers every 3 – 5 years, creating a catastrophic increase in E-waste, which is already up 82% since 2010, resulting in a long trail of environmental damage. The Earth is struggling to bear the weight of this mounting electronic debris, threatening our environment and health with irreversible damage. On top of that, the new servers that companies must then buy require an unfathomable amount of carbon emissions: in fact, 50% of the emissions over the entire server life comes from manufacturing. This is where TPM comes in, an indispensable part of the quest for Green IT. According to a report from Thinkstep, the manufacturing phase causes 40 – 50% of the total global warming potential across the server lifecycle. This means that replacing a server not only generates waste from disposal, but also leads to extensive Scope 3 emissions from the new server.

As TPM is far cheaper and environmentally sustainable than buying servers more often, companies will be under strong pressure to move towards TPM. We expect TPM to grow by 20% per year over the next few years, especially with the additional focus on TPM and ESG. Investing in TPM is a tremendous opportunity to offset the reduction in the ITAD market due to these very same factors.



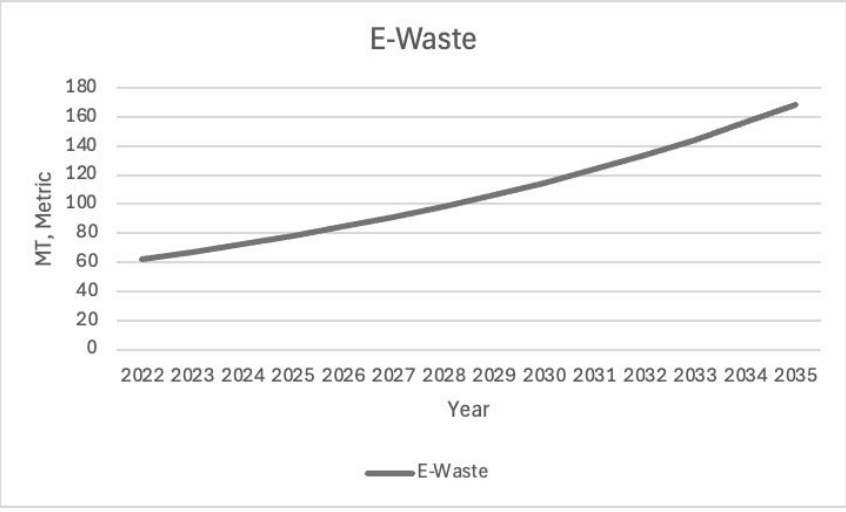
Source: Thinkstep, Dell Study

Environmental Impact – Details

Electronic waste (e-waste), is a byproduct of data center refresh activity and is harming the environment significantly. The world generated 20–50 metric tons of E-Waste each year as of 2018, sending toxins such as heavy metals straight into landfills. An EPA report states that e-Waste accounted for a staggering 70% of all toxic waste worldwide. The 62 million tonnes of e-waste generated in 2022 would fill 1.55 million 40-tonne trucks, roughly enough trucks to form a bumper-to-bumper line encircling the equator, according to the report from ITU and UNITAR. If the unsustainable status quo continued, e-Waste would grow 8% each year, doubling every 9 years. The volume of global eWaste would reach 74.7– 82 metric tons by 2030. Specifically, the UN estimated that the electronic waste is rising five times faster than documented e-waste recycling. Just as harmful, replacing machines and equipment leads to emissions. The carbon contribution for an average 1 MW data center includes 33,000lbs of emissions from its plastic, 73,000lbs from aluminum and 377,000lbs from steel.

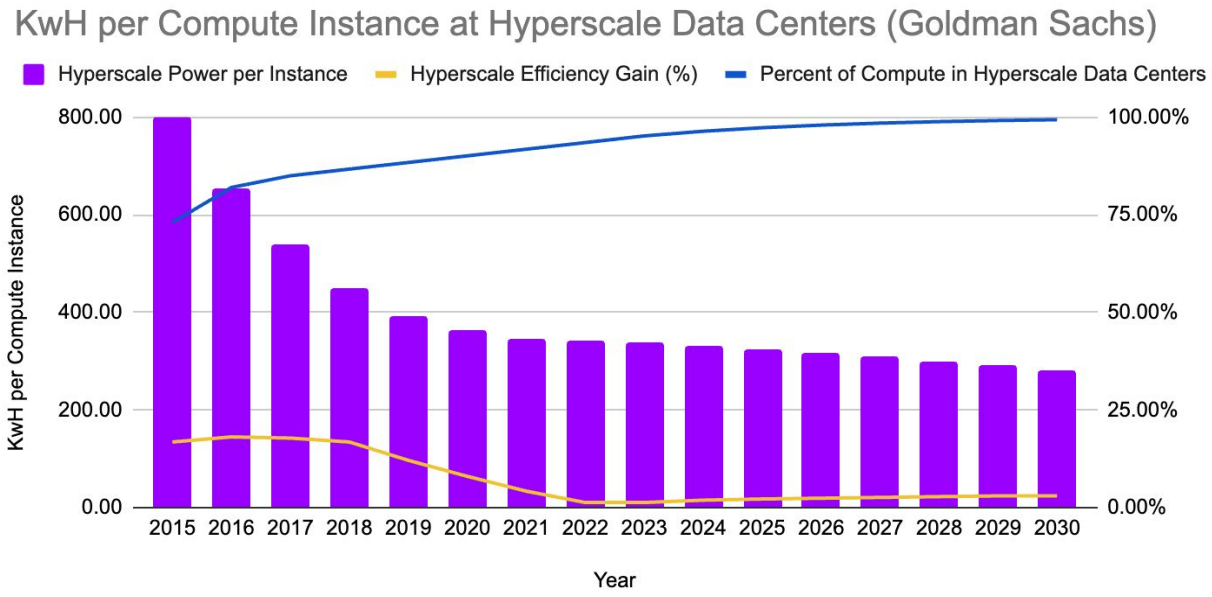
This highlights the severe environmental impact and the pressing need for sustainable solutions. E-waste reduction is thus an imperative on a global scale, but who is to blame? On average, 47% of data centers were refreshing their systems every 1-3 years and another 28% every 4-5 years and large companies with over $1B+ in market cap were twice as likely to refresh systems each year compared to small businesses. Hyperscale data centers fit the bill perfectly, and this is exactly where TPM comes in.

TPM is by far the most efficient solution to the E-Waste problem. With having the ability to extend the life of hardware to 9-12+ years, it reduces the number of hardware being thrown out every year. If more companies adopted TPM for most of their hardware, we would see a major reduction in the waste problem. As mentioned before, Only 22% of this e-waste was disposed of safely, and even in Europe and Oceania, the best performing regions, only 42% of E-Waste was documented. This is where the true hero comes in, ITAD companies, which are known to securely and safely dispose of all E-waste with environmentally safe measures. We see companies recognizing this within the next 5 years because of the hard push for ESG and strict environment regulatory measures. Allowing ITAD companies to dispose of the harmful E-Waste on a massive scale would increase the percentage of e-waste disposed s



Quantitative Data from GS and Implications

A report by Goldman Sachs projects the power use efficiency in hyperscale data centers to improve by much less than it had in the prior decade. This would mean that the energy use improvements from new hardware is not worth the emissions.



The source provides the historical hyperscale power per “compute instance”, the historical and forecasted hyperscale efficiency gains, and the historical percentage of compute in hyperscale data centers. A compute instance refers to a virtual machine, and in this diagram is standardized in size. GS defined the efficiency gain as the percentage decrease in power consumption per compute instance. Since over 90% of the world’s computing power is now located at hyperscale data centers, the effect of power efficiency gains at traditional data centers is insignificant. Therefore, we used the percentage hyperscale efficiency gain from the source to deduce the future hyperscale power per instance according to a multiplicative formula based on the definition of percentage change.

$$E(kwh/ci_t) = E(kwh/ci_{t-1}) * [1 - E(powereffgain_{t-1})].$$

The chart above is thus a combination of the Goldman Sachs forecasts and their implications for future energy consumption. Notice how the energy efficiency per instance is still improving, but much more slowly than before.

Data Analysis

Our research question from this data was whether the reduced efficiency gain at servers contributed to the lengthened refresh cycles. We ran a regression analysis of the average refresh cycle length interpolated from the Refresh Cycles spreadsheet combined with the Goldman Sachs historical data. There was not enough evidence to state at conventional statistical confidence levels that either the number of GPUs or the GPU vs CPU market size ratio affects the refresh cycle with the limited data available. Therefore, we only analyzed the efficiency gain, and found that as power use per instance decreases more slowly, the refresh cycles tend to lengthen.

```
[6] import pandas as pd
    from statsmodels.formula.api import ols
    data = pd.read_csv("final_reg.csv")
    model = ols("refresh ~ eff_gain", data = data).fit()
    print(model.summary())
```

```
                            OLS Regression Results
==============================================================================
Dep. Variable:                refresh   R-squared:                       0.944
Model:                            OLS   Adj. R-squared:                  0.933
Method:                 Least Squares   F-statistic:                     84.26
Date:                Sat, 15 Jun 2024   Prob (F-statistic):           0.000257
Time:                        18:11:08   Log-Likelihood:                 2.9986
No. Observations:                   7   AIC:                            -1.997
Df Residuals:                       5   BIC:                            -2.105
Df Model:                           1
Covariance Type:            nonrobust
==============================================================================
                 coef    std err          t      P>|t|      [0.025      0.975]
------------------------------------------------------------------------------
Intercept      5.5546      0.125     44.338      0.000       5.233       5.877
eff_gain     -11.2629      1.227     -9.179      0.000     -14.417      -8.109
==============================================================================
Omnibus:                        nan   Durbin-Watson:                   1.694
Prob(Omnibus):                  nan   Jarque-Bera (JB):                0.704
Skew:                        -0.326   Prob(JB):                        0.703
Kurtosis:                     1.590   Cond. No.                         17.5
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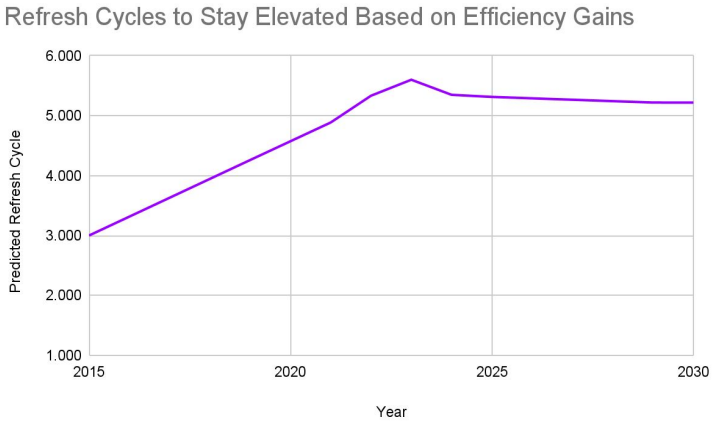

According to the coefficients, a 1% decrease in the power efficiency gain in any given year, the refresh cycle tends to increase by 0.1126 years or 1.35 months. Since the power efficiency gain has been rapidly decreasing, we expect the average refresh cycles to stay very high – above 5 years up to 2030. When refresh cycles are this high, TPM usage will likely be high as well. However, this association also suggests that a major risk is the adoption of newer, more efficient chips.

Regulatory Factors

Recent regulations around the world are starting to force OEMs to move towards a more circular, green IT lifecycle. Since 2020, UK manufacturers have been required to provide product and assembly information alongside replacement components, allowing TPMS to work more easily. The Right to Repair legislation would also reduce the power of OEMs to enforce their desired refresh cycle; a common provision is requiring OEMs to provide the information and tools necessary to repair machines. This will increase the quality of TPM and decrease the cost of providing TPM. Unfortunately, regulations that require OEMs to design more sustainable servers to begin with may work against the TPM industry. Given the emissions potential of the manufacturing process, however, we do not believe this impact will be severe. As the impacts of global warming and pollution become more evident, we predict that these regulations will become more common and stringent.